

DOCUMENT RESUME

ED 265 078

SE 046 379

AUTHOR Hider, Rebecca Ann; Rice, Dale R.
TITLE A Comparison of Instructional Mode on the Attitude and Achievement of Fifth and Sixth Grade Students in Science.
PUB DATE 86
NOTE 16p.
PUB TYPE Reports - Research/Technical (143)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Academic Achievement; Attitude Change; *Cerebral Dominance; *Elementary School Science; Grade 5; Grade 6; Intermediate Grades; Science Education; *Science Instruction; *Student Attitudes; *Teaching Methods
IDENTIFIERS *Brain Hemisphere Functions; Science Education Research

ABSTRACT

This study analyzed the differences in attitude and achievement of fifth- and sixth-grade subjects presented with a series of science lessons directed toward instructional procedures which addressed the right hemisphere, the left hemisphere, or both hemispheric processing modes. The study used 65 randomly selected students divided into four instructional groups. Each group (except the control group) received instruction on a unit dealing with electricity using three different instructional modalities. Pre- and post-test assessment of attitudes and achievement gains were administered. Findings indicate that significant gains in achievement were greatest in the left hemisphere, textbook approach, although this group displayed the lowest gains in attitude. The greatest gains in attitude occurred in the approach utilizing an integrated left-right hemispheric approach; this group also showed significant gains in achievement. The study's conclusions imply that elementary science teachers should alter their instruction to include, along with the textbook approach, hands-on, manipulative activities. In this way both brain processing modes can be utilized to improve both the achievement and attitudes of students in the elementary science classroom. (Author/JN)

* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *

↓ This document has been reproduced as
received from the person or organization
originating it.
Minor changes have been made to improve
reproduction quality.

• Points of view or opinions stated in this docu-
ment do not necessarily represent official NIE
position or policy.

A Comparison of Instructional Mode on the
Attitude and Achievement of Fifth and
Sixth Grade Students in Science

by

Rebecca Ann Hider
Graduate Student

and

Dale R. Rice
College of Education
University of South Alabama
Mobile, Alabama 36688

Running Head: A Comparison of Instructional Mode

"PERMISSION TO REPRODUCE THIS
MATERIAL HAS BEEN GRANTED BY

Dale R. Rice

TO THE EDUCATIONAL RESOURCES
INFORMATION CENTER (ERIC)."

ED265078

SE 046379

Abstract

This study analyzed the differences in attitude and achievement of fifth-and sixth-grade subjects presented with a series of science lessons directed toward instructional procedures which addressed the right hemisphere, the left hemisphere, or both hemispheric processing modes. The study group consisted of sixty-five (65) randomly selected students divided into four instructional groups. Each group, except Group 4, which served as the control group, received instruction on a unit dealing with electricity using three different instructional modalities. Pre- and post-test assessment of attitudes and achievement gains were conducted for each instructional group. Data analysis indicated that significant gains in achievement were greatest in the left hemisphere, textbook approach, although this group displayed the lowest gains in attitude. The greatest gains in attitude occurred in the approach utilizing an integrated left-right hemispheric approach. This group also showed significant gains in achievement. The study's conclusions imply that elementary science teachers should alter their instruction to include, along with the textbook approach, hands-on, manipulative activities in teaching science. In this way both brain processing modes can be utilized to improve both the achievement and attitudes of students in the elementary science classroom.

A Comparison of Instructional Mode on the
Attitude and Achievement of Fifth- and
Sixth-Grade Students in Science

Introduction

For students to meet the challenges of the world in which they live, it is important that they be encouraged to develop their total range of skills and abilities in science. It is important that they have at their disposal many and varied means of problem solving and critical thinking skills. This point is emphasized by the prediction of futurists that novel, rather than conventional solutions, will be needed to cope with the demands of the coming age--solutions that will require resourcefulness in moving from established ways of looking at problems in science to new viewpoints and alternatives (McCormack, 1977). Research indicates, however, that students are not being trained to be imaginative or inventive. This is especially true in the elementary science classroom. Instruction in science has traditionally excluded activities which nurture imagination and intuition. Instead, instruction in elementary science has been focused primarily on one end of the continuum of learning: the development of the analytic, logical thinking mode (Ornstein, 1972; Galin, 1976; Rennels, 1975).

Recent discoveries in the field of hemispheric brain functioning are helpful in understanding this imbalance. These discoveries have shed new light on the way children learn in school. It has been found that each of the two cerebral hemispheres has specialized functions and styles. The

characteristics of the left hemisphere are exemplified in the behaviors typically rewarded in the elementary science classroom: logic, reason, and analysis. Unfortunately the characteristics of the right hemisphere, the imaginative and holistic functions, are the ones that have so long been neglected.

However, if students are to develop both hemispheres of the brain (Wolfe & Reising, 1978). This task is clarified when considering the fact that the analytic and holistic modes of learning are complementary. Each mode provides a dimension that the other lacks. It is this complementary integration of the two modes that forms the basis for creativity (Galín, 1976). Galín's statements are supported by Ornstein (1972) who further explains that it is the polarity and integration of the two modes, "the complementary workings of the intellect and the intuitive, which underlie our highest achievements" (p. 80). Rennels (1975) concurs by stating that the focus of education should be upon the total reasoning processes of both hemispheres.

It would seem then, in the omission of right hemispheric activities, educators have left half of their students' potential untapped. Would inclusion in the curriculum of activities geared toward the right brain hemisphere help in rectifying the imbalance found in the educational process? Furthermore, how would activities oriented toward both brain hemispheres aid in fostering improved attitudes and developing higher achievement levels? Research dealing with the effect instruction oriented to the processing modes of the brain hemispheres has on student achievement and attitude is at best extremely limited. In order

to test the effect that varied instructional modalities have on students' achievement and attitudes, a research study was designed to discover if a more balanced approach to the teaching-learning process resulted in an increase in achievement and attitudes of fifth- and sixth-grade students in science.

Statement of the Problem

The purpose of this study was to investigate the effect of instruction oriented toward the processing modalities of the left hemisphere, the right hemisphere or the integration of both hemispheres had on the achievement and attitudes of fifth- and sixth-grade students in science. The following questions were addressed: (1) Will science instruction oriented toward a left-hemispheric, textbook approach improve students' attitudes and achievement? (2) Will science instruction oriented toward a right-hemispheric, hands-on, inquiry approach improve student attitudes and achievement? (3) Will science instruction oriented toward an integrated approach, involving both left and right brain hemispheres improve students' attitudes and achievement? and (4) What instructional mode will produce the greatest increase in attitude and achievement during post-test assessment?

Method

The subjects (Ss) were sixty-five (65) randomly selected fifth and sixth grade students from a predominantly white, rural elementary school in southern Alabama. The design of the study consisted of the separate-sample, pre-test-post-test control group design as outlined by Campbell and Stanley (1963). All of the

Ss were randomly assigned one of four treatment groups. Group 1 received instruction in which scientific content was presented through the use of a textbook approach employing lectures and follow-up written assignments. This approach was oriented toward the processing style of the left hemisphere. Group 2 received instruction consisting of hands-on, manipulative materials covering the same content as Group 1. No textbook was used and the teaching approach was oriented toward the processing style of the right hemisphere. Group 3 received instruction which included both the processes of science and the content approach. A mixture of textual presentation, written assignments and process-oriented, hands-on experiences were utilized. This approach supported both hemispheric processing modes of the brain. Group 4 served as the control group and received no instruction on the science unit. Activities dealing with mathematics and social studies were presented to Group 4 during each instructional session.

On the first day of a two-week instructional period, half of the Ss (N=32) were given a pre-test dealing with their attitude toward science and an achievement test to measure their knowledge of electricity. The School Subjects Attitude Scale developed by Nyberg and Clark (1978) was used to measure student attitude toward science. The instrument employs the semantic differential technique to measure Ss responses on 24 bipolar adjectives toward science. A criterion-referenced test on electricity consisting of 20 multiple choice items was developed to measure students' knowledge of concepts dealing with electricity. During the last class period the remaining students (N=33) who had not taken the

pre-test received the post-test. All instruction during the treatment period was identical in content and taught in 25 minute time periods by the lead author.

Results

The pre-test was analyzed by the Analysis of Variance (ANOVA) on each of the 24 bipolar adjectives on the School Subjects Attitude Scale and the achievement test scores. No significant differences were found.

Data analysis revealed that on the post-test, however, significant differences were found on eleven of the 24 bipolar adjectives on the attitude scale ($p < .05$) and in achievement ($p < .01$). See Tables 1 and 2.

Insert Tables 1 and 2 about here

When examining changes in attitude, the results of the study suggest that gains in attitude were evidenced in all three experimental groups with significant gains occurring in the Textbook Group (1), the Hands-on Group (2), and the Intergrated Group (3). However, the Intergrated Group (3) demonstrated more than three-times the positive gain attitude scores on the 24-item attitudinal scale than the Textbook Group (1) or the Hands-on Group (2). It was also found that the Hands-on Group (2) had an increase in attitude greater than the Textbook Group (1). Thus, the greatest positive change in attitude occurred in the treatment group receiving both a textbook oriented and inquiry, hands-on

approach. Little or no attitudinal change was observed in the textbook approach group.

Achievement scores improved in all three treatment groups with the greatest improvement occurring in the group using the textbook, left-hemispheric approach to instruction. The Hands-on, inquiry, right-hemispheric approach resulted in the least gain in achievement scores on the post-test (See Table 3).

Insert Table 3 about here

Conclusions

The findings of the current study indicate that although all three methods of science instruction used, the Textbook, Hands-on, and the Intergrated Approaches, resulted in academic gains, gains were significantly higher in the two approaches tested which employed textual materials. It is possible that this result occurred due to the fact that this was the manner in which the students were most familiar in receiving science instruction. Interestingly enough, however, the Textbook Group (1) scored the lowest--outranking only the Control Group (4)--in positive gains in student attitude after treatment.

If credence is to be given to the current trend among the majority of science educators and curriculum developments, that of placing an increased emphasis on the development of positive attitudes in students, then a method must be utilized that combines both academic gains and positive attitude development. This study reveals that the Intergrated Approach resulted in not

only a significant gain in student achievement but also the highest positive increase of all four groups tested in the area of attitude. Thus, data analysis reveals that science instruction should emphasize the benefits of combining a textual presentation, a left-hemispheric approach to science education, with process-oriented experiences, a right-hemispheric approach, into a combinational program where students are involved in using both processing modes of the brain hemispheres. In this way, students who learn better through manipulative methods will serve as well as those who benefit from verbal and analytical attack of the subject matter.

The results of this study indicate that elementary teachers have at their disposal the means to develop in children positive attitudes toward science along with the development of academic gains. Data from this investigation suggests that teachers should be more aware that instruction must consist of an integration of textbook materials with hands-on experiences. In such an approach, individual differences will be best served. Students should be given the opportunity to shift repeatedly between a left-hemispheric or product approach to science and a right-hemispheric or process approach.

Furthermore, teachers should be made aware of the physiological bases of both the right and left hemispheric brain processing style. This information can be used to individualize instruction to meet the needs of children in science. Finally, the attainment of academic gains, accompanied by the development of positive attitudes toward science can be accomplished to the

maximum level when science program is employed where students are actively involved in their learning.

Table 1
Means of Significant Differences on the 24-Item
Attitudinal Scale on the Post-Test

VARIABLE	MEANS			
	GR I	GR II	GR III	GR IV
Nice - Awful	3.90	4.44	4.00	3.40
*Interesting - Boring	3.40	4.44	4.60	3.00
Pleasant - Unpleasant	3.80	3.89	4.00	3.20
*Like - Dislike	3.50	4.22	4.30	2.60
Bright - Dull	2.90	3.56	4.00	2.40
Alive - Dead	3.10	4.00	3.80	2.40
Lively - Listless	2.80	3.11	3.60	2.80
*Exciting - Tiresome	2.60	3.78	4.40	2.80
Useful - Useless	4.20	4.22	4.40	3.20
Important - Unimportant	4.90	4.78	4.40	4.40
Practical - Impractical	3.30	3.33	4.20	2.60
*Valuable - Worthless	3.00	4.33	4.20	2.20
Helpful - Unhelpful	4.50	4.22	4.60	3.20
Necessary - Unnecessary	3.80	4.11	4.40	3.00
Advantageous - Harmful	3.20	4.22	4.40	3.60
Meaningful - Meaningless	4.10	4.67	4.30	4.40
*Easy - Hard	2.30	4.78	4.70	2.20
*Light - Heavy	2.20	4.22	4.20	2.00
Clear - Confusing	3.30	3.89	4.20	2.60
*Simple - Complicated	3.20	4.33	4.20	2.40
Elementary - Advanced	2.80	3.89	3.80	3.60
*Familiar - Strange	3.00	4.33	3.50	1.80
*Understandable - Puzzling	2.90	4.33	4.70	2.40
*Undemanding - Rigorous	2.50	4.33	3.90	2.80

*Indicated Significant Differences ($p < .05$) on ANOVA

Note: The liker t scale was based on the following scores:

- 5 - most positive evaluation
- 1 - least positive evaluation

Table 1
Means of Significant Differences on the 24-Item
Attitudinal Scale on the Post-Test

VARIABLE	MEANS			
	GR I	GR II	GR III	GR IV
Nice - Awful	3.90	4.44	4.00	3.40
*Interesting - Boring	3.40	4.44	4.60	3.00
Pleasant - Unpleasant	3.80	3.89	4.00	3.20
*Like - Dislike	3.50	4.22	4.30	2.60
Bright - Dull	2.90	3.56	4.00	2.40
Alive - Dead	3.10	4.00	3.80	2.40
Lively - Listless	2.80	3.11	3.60	2.80
*Exciting - Tiresome	2.60	3.78	4.40	2.80
Useful - Useless	4.20	4.22	4.40	3.20
Important - Unimportant	4.90	4.78	4.40	4.40
Practical - Impractical	3.30	3.33	4.20	2.60
*Valuable - Worthless	3.00	4.33	4.20	2.20
Helpful - Unhelpful	4.50	4.22	4.60	3.20
Necessary - Unnecessary	3.80	4.11	4.40	3.00
Advantageous - Harmful	3.20	4.22	4.40	3.60
Meaningful - Meaningless	4.10	4.67	4.30	4.40
*Easy - Hard	2.30	4.78	4.70	2.20
*Light - Heavy	2.20	4.22	4.20	2.00
Clear - Confusing	3.30	3.89	4.20	2.60
*Simple - Complicated	3.20	4.33	4.20	2.40
Elementary - Advanced	2.80	3.89	3.80	3.60
*Familiar - Strange	3.00	4.33	3.50	1.80
*Understandable - Puzzling	2.90	4.33	4.70	2.40
*Undemanding - Rigorous	2.50	4.33	3.90	2.80

*Indicated Significant Differences ($p < .05$) on ANOVA

Note: The liker t scale was based on the following scores:

- 5 - most positive evaluation
- 1 - least positive evaluation

Table 2
Analysis of Post-Test Achievement Scores

Source	<u>df</u>	<u>SS</u>	<u>MS</u>	<u>F</u>
Between Groups	3	127.99	42.66	5.10*
Within Groups	30	250.96	8.37	
Total	33	378.94		

*p < .01

Table 3
Comparison of Mean Achievement Scores
Between the Pre- and Post-Test

	<u>Pre-test</u>	<u>Post-test</u>	<u>Difference</u>
Group I (Textbook Approach)	6.71	14.70	7.99
Group II (Hands-on Approach)	7.14	11.78	4.64
Group III (Integrated Approach)	8.20	14.70	6.50
Group IV (Control)	7.17	9.60	2.43

References

- Campbell, D.T. & Stanley, J.C. Experimental and quasi-experimental designs for research. Chicago: Rand McNally, 1963.
- Galín, D. Educating both halves of the brain. Childhood Education, October, 1976, 53:17-20.
- McCormack, A.J. Letting in the lateral: New outlooks in creativity. The Science Teacher, October, 1977, 44:30-33.
- Nyberg, V.R. & Clark, S.C.T. Technical report on the school subjects attitude scale. Alberta, Canada: University of Alberta, 1979. (ERIC Document Reproduction Service No. ED 179 575)
- Ornstein, R.E. The psychology of consciousness. New York: W.H. Freeman, 1972.
- Rennels, M.S.R. Cerebral symmetry: An urgent concern for education. Phi Delta Kappan, March, 1976, 57: 471-472.
- Wolfe, D.T., Jr. & Reising, R.W. Politics and English teaching or (can, should, will) we teach the whole brain? English Journal, May, 1978, 67: 29-32.